A Comparison between EPA 2011NEIv2 and 2011NEIv1 Mobile Source Inventory: Extended Idling and Vehicle Classification

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Extended Idling

Evaluations:
Method1: Truck Stop Parking Spaces
Method2: Emission Factors
Method3: Number of Idling Vehicles

EXT-APU: Extended Idling -- Auxiliary Power Unit

Idling Evaluation: Truck Parking Spaces

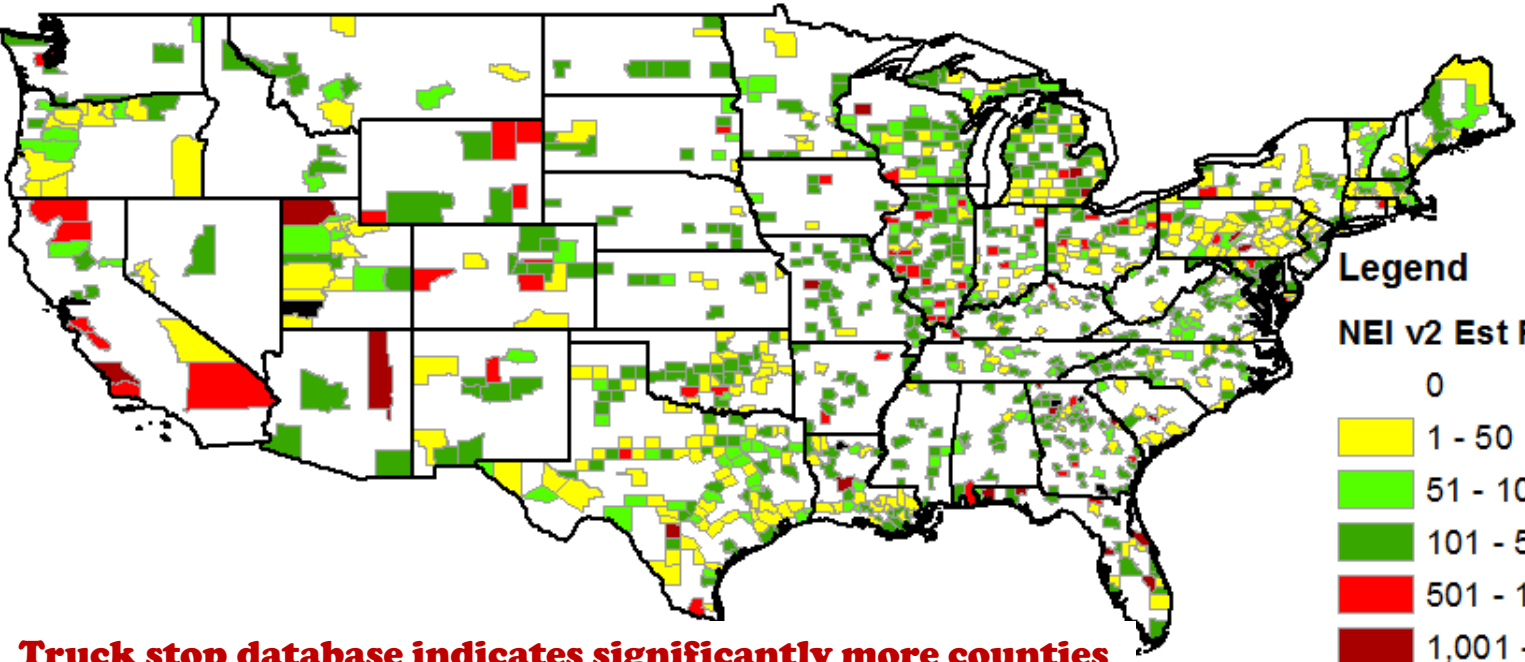
- **2011NEIv2 hotelling hours:**

  Truck spaces by county =

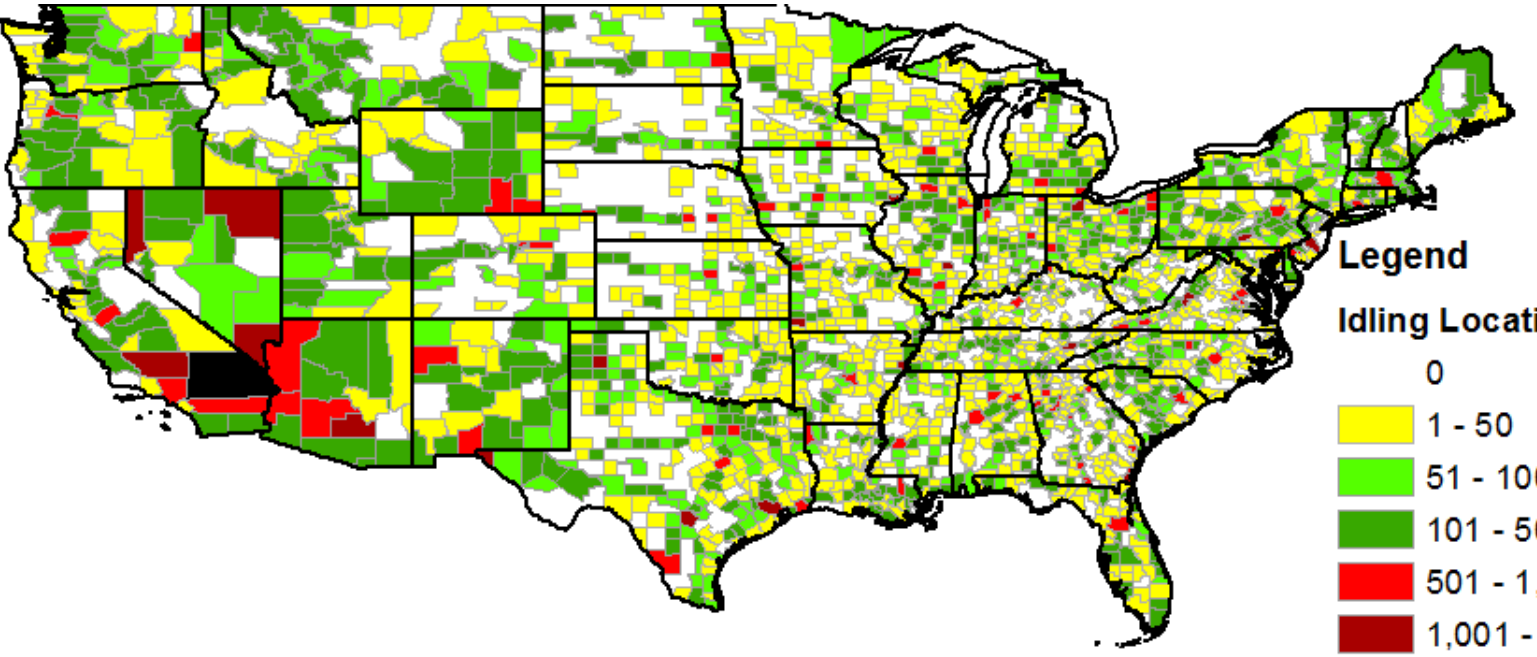
  Annual hotelling hours / 10 hours/ 365 days;

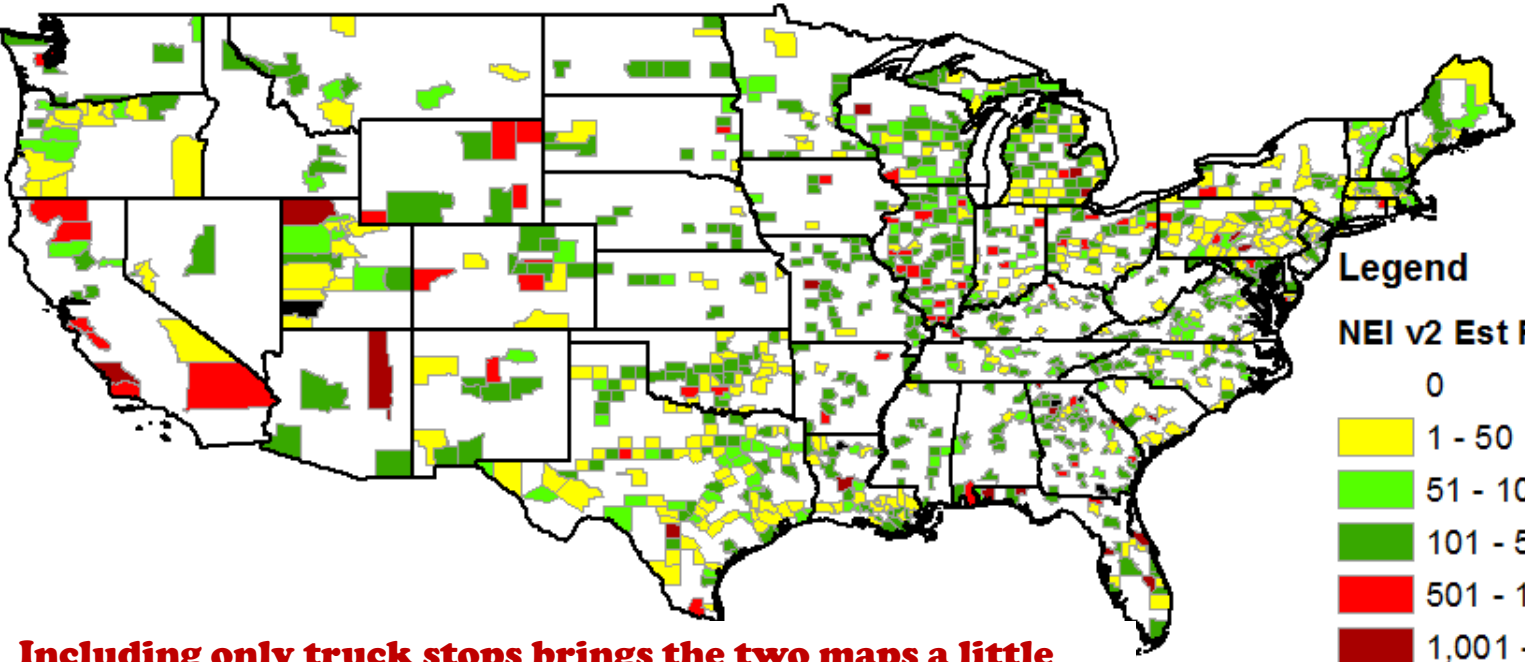
  Assuming truckers must rest 10 hours a day, this gives minimum available truck spaces required for a county (concept originated from GAEPD)

- **Truck stop dataset compiled by Zac Adelman at UNC**
  - **1st draft was developed by VADEQ from Allstays.com**
  - **Augmented to include truck parking spaces available at parking areas, rest areas, retail locations, truck stops, visitor centers, weigh stations, and welcome centers**
  - **Includes a low, mid, and high estimate of the number of truck spaces at each location**
  - **Reviewed and supplemented by states**
  - **Latest version received on 11/25/2014**
  - **Used the "high" estimate for each location and summed truck spaces by county**

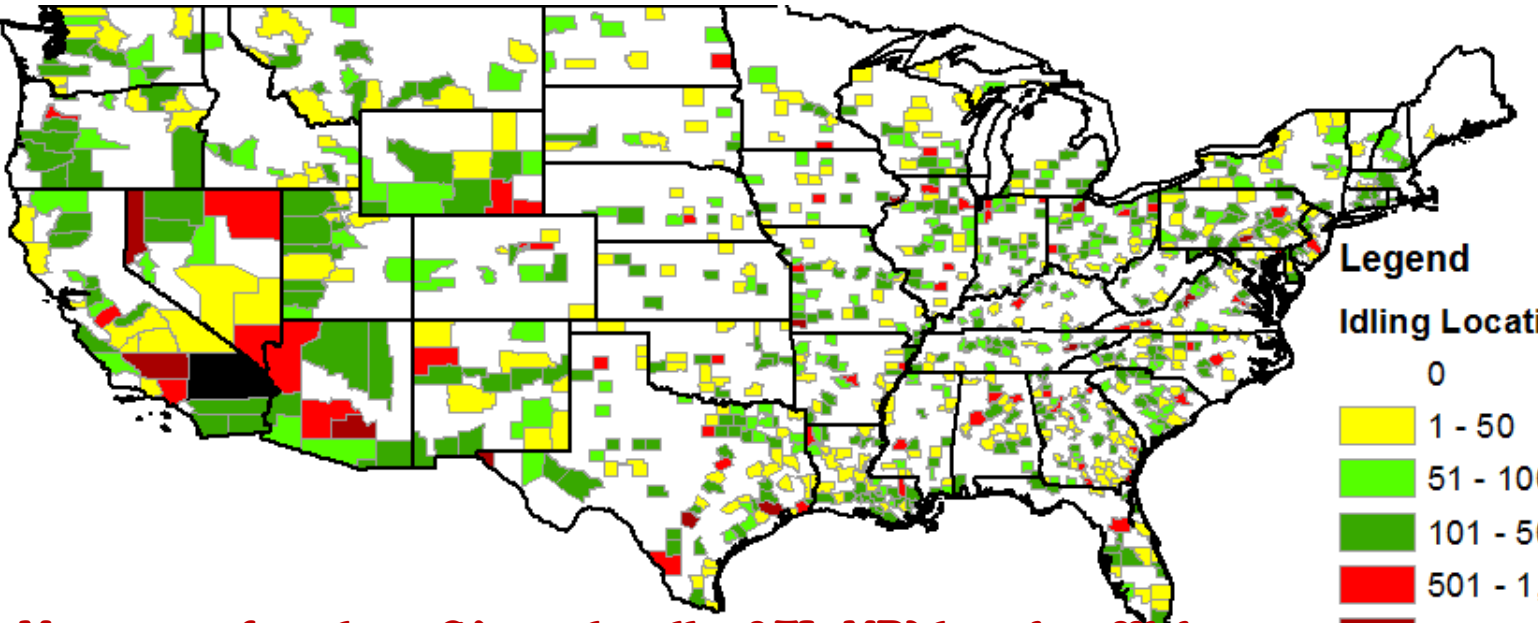


Truck stop database indicates significantly more counties with available truck parking spaces





Including only truck stops brings the two maps a little closer



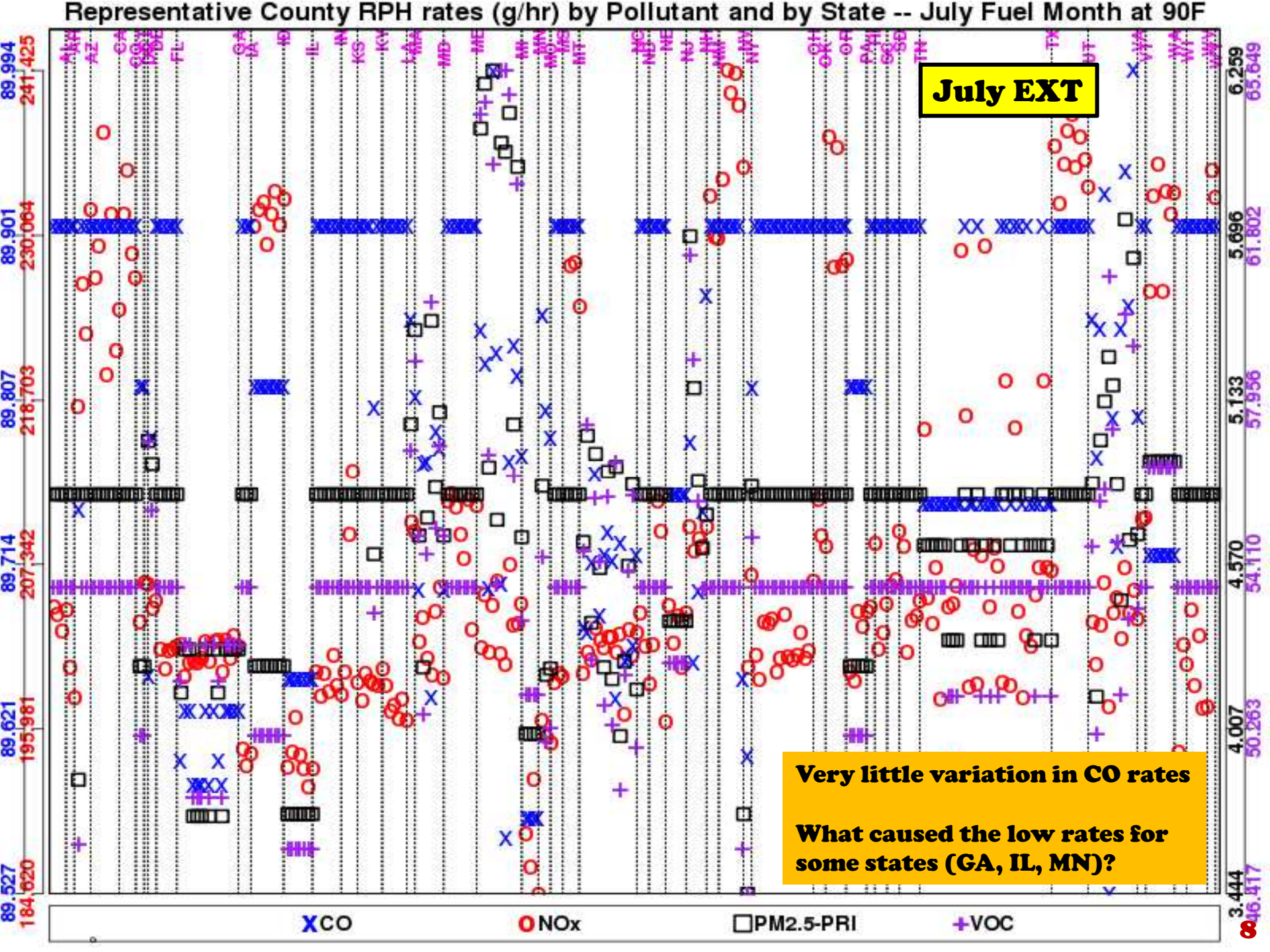
Many areas (southern CA, panhandle of FL, MD) have insufficient truck stops to accommodate number spaces included in 2011NEIv2

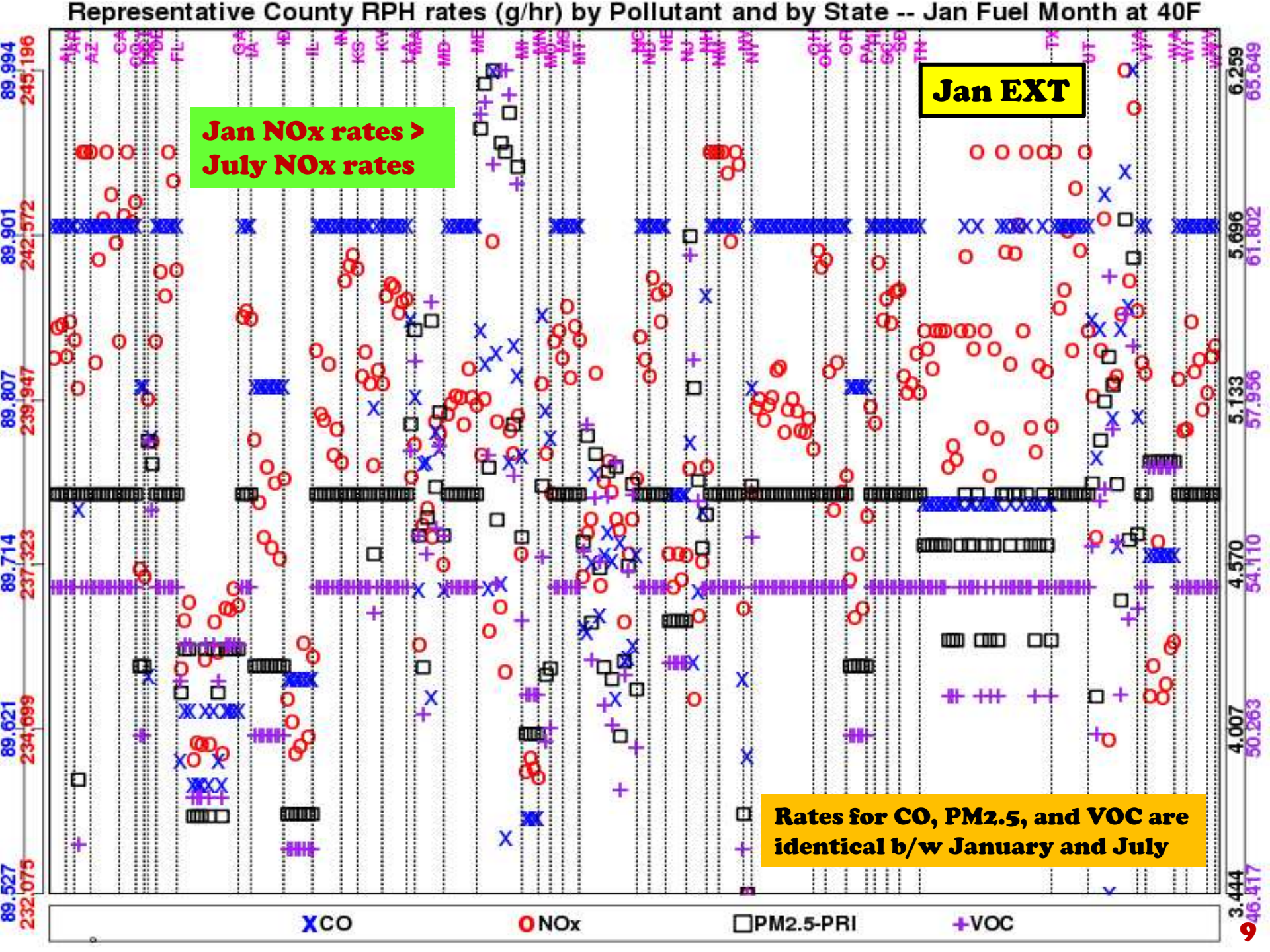
Summary on Truck Parking Spaces

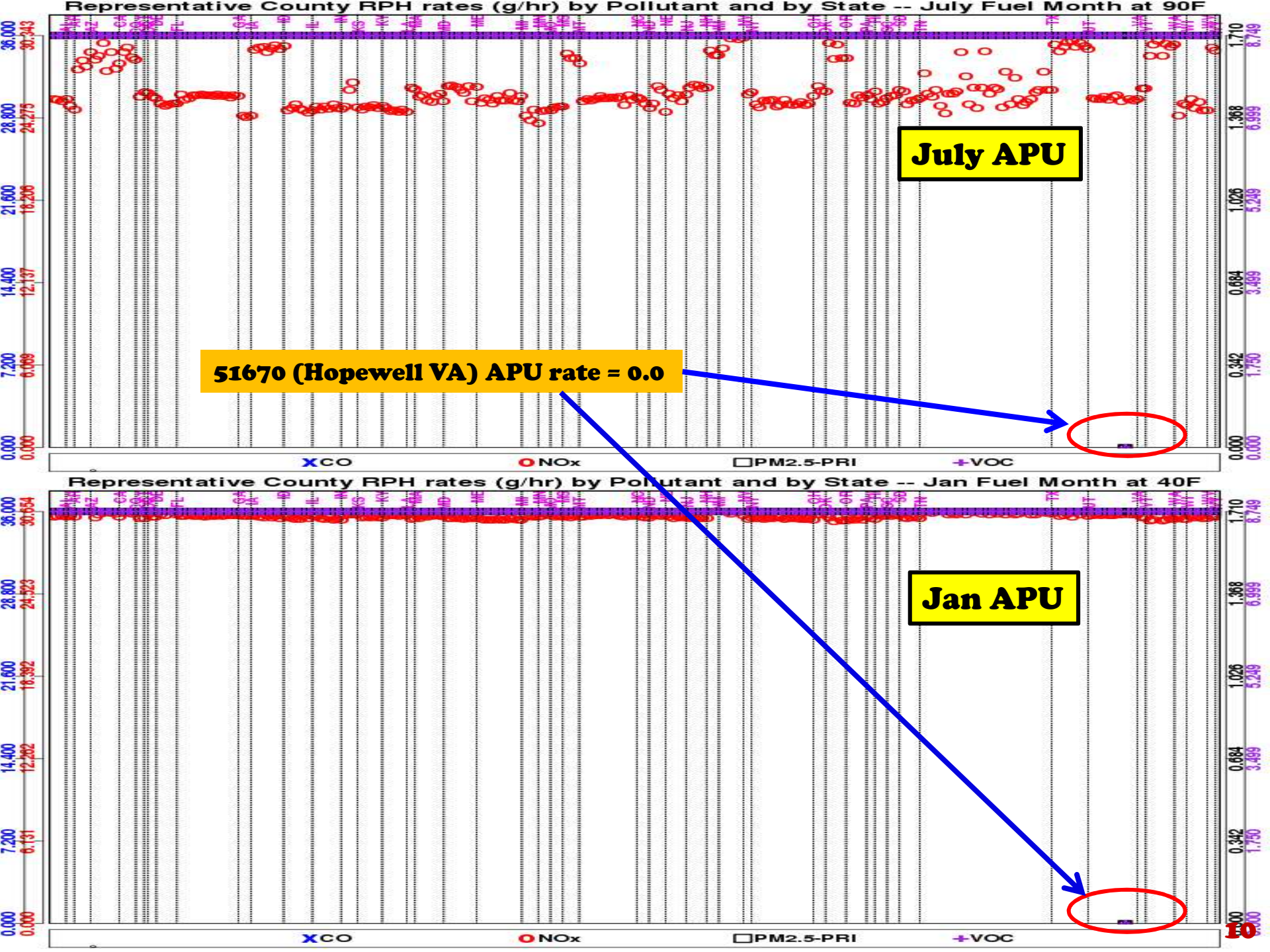
- More parking spaces are required in 2011NEIv2 than exist in the Zac Adelman database
- The Truck stop database is not closely aligned with the idling that is occurring
- Could USEPA please provide methodology for estimating the idling hours for states that did not supply state specific data?

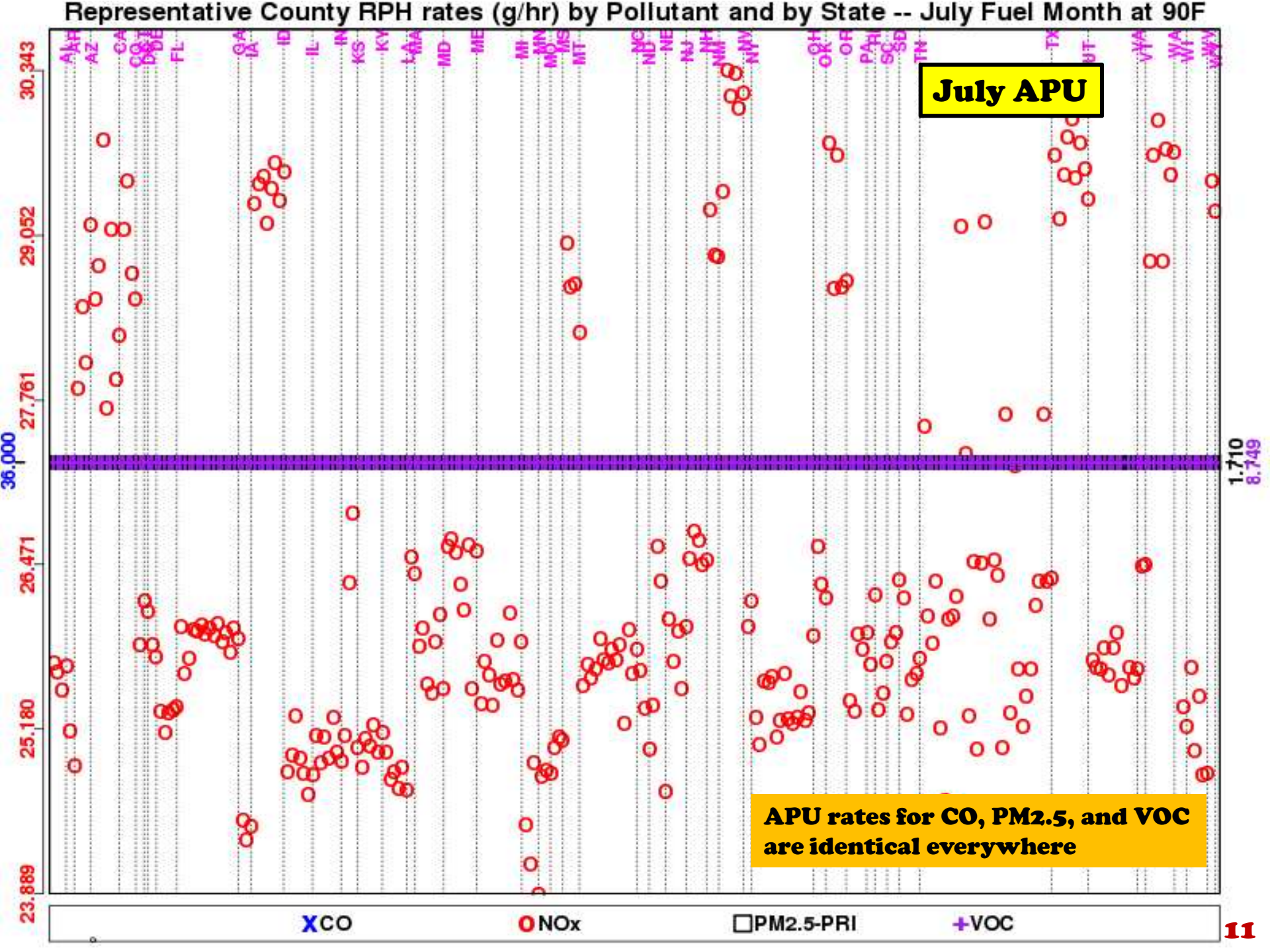
Idling Evaluation: Emission Factors

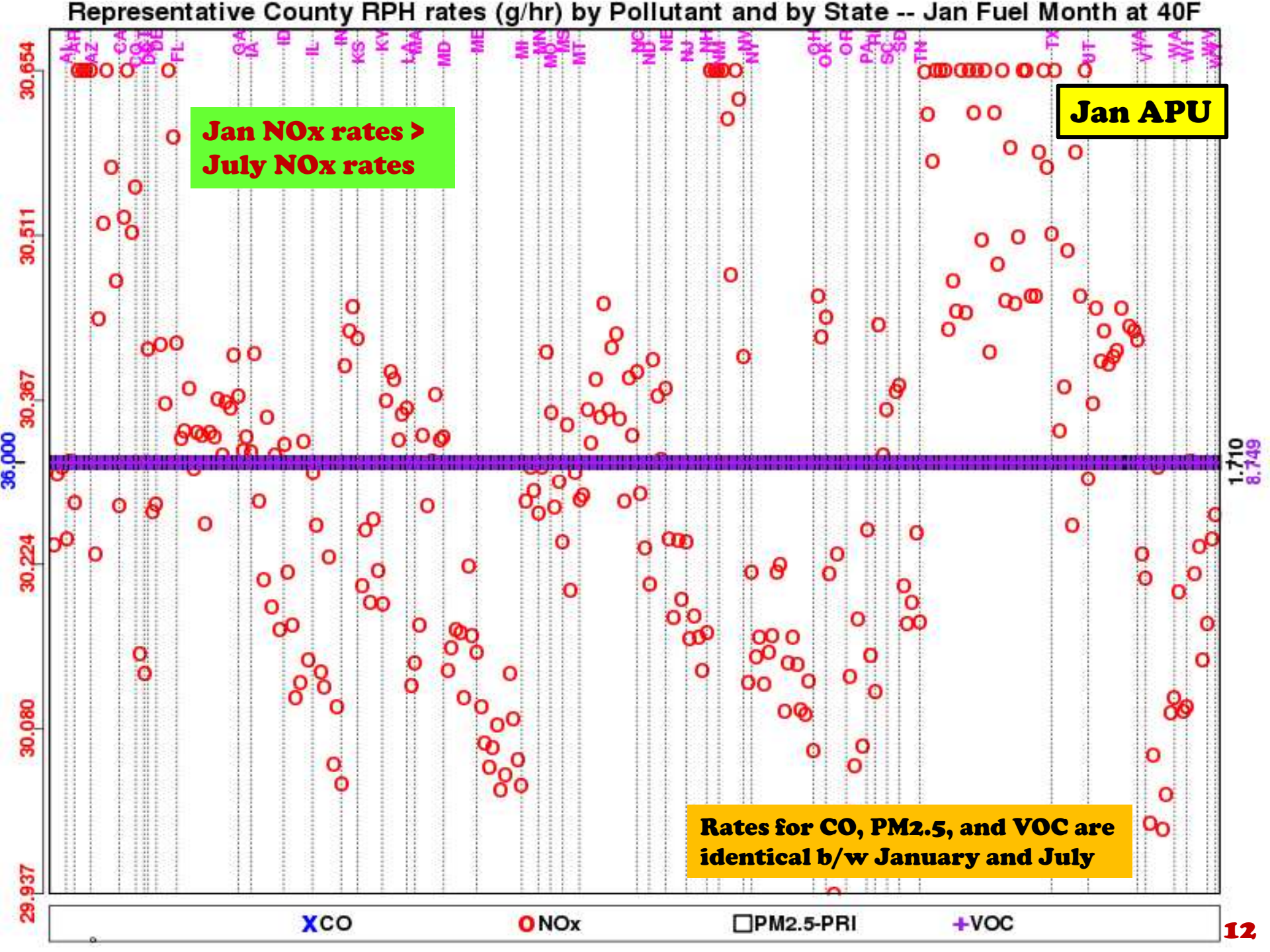
- Idling Hours
  - Provided by EPA and revised by states
  - Methodology uncertain
  - Estimated by individual county
  - Primarily assigned to counties with rural interstates
- Idling emission factors
  - Calculated in MOVES
  - Tabulated in RPH (rate per hour, g/hr) lookup tables
  - Vary by
    - Representative county (like RPD, RPV, or RPP)
    - Fuel month (1 and 7) and temperature
  - Only two SCCs, 2202620153 (EXT) and 2202620191 (APU)
- Extracted two sets of data for examination:
  - fuel month 7, temperature 90F
  - fuel month 1, temperature 40F


Representative County RPH rates (g/hr) by Pollutant and by State -- July Fuel Month at 90F
July EXT
Very little variation in CO rates
What caused the low rates for some states (GA, IL, MN)?
XCO
ONOx
PM2.5-PRI
+VOC
89.994
241.425
89.901
230.064
89.807
218.703
89.714
207.342
89.621
195.981
89.527
184.620
6.259
65.649
5.696
61.802
5.133
57.956
4.570
54.110
4.007
50.263
3.444
46.417


Representative County RPH rates (g/hr) by Pollutant and by State -- Jan Fuel Month at 40F
Jan EXT
Jan NOx rates > July NOx rates
Rates for CO, PM2.5, and VOC are identical b/w January and July
89.994
245,196
89.901
242,572
89.807
239,947
89.714
237,323
89.621
234,699
89.527
232,075
6.259
65.649
5.696
61.802
5.133
57.956
4.570
54.110
4.007
50.263
3.444
46.417
XCO
ONOx
PM2.5-PRI
+VOC


Representative County RPH rates (g/hr) by Pollutant and by State -- July Fuel Month at 90F
July APU
51670 (Hopewell VA) APU rate = 0.0
XCO
NOx
PM2.5-PRI
VOC
Representative County RPH rates (g/hr) by Pollutant and by State -- Jan Fuel Month at 40F
Jan APU
XCO
NOx
PM2.5-PRI
VOC


Representative County RPH rates (g/hr) by Pollutant and by State -- July Fuel Month at 90F
July APU
30.343
29.052
27.761
36.000
26.471
25.180
23.889
1.710
8.749
APU rates for CO, PM2.5, and VOC are identical everywhere
XCO
ONOx
PM2.5-PRI
+VOC


Representative County RPH rates (g/hr) by Pollutant and by State -- Jan Fuel Month at 40F
Jan NOx rates > July NOx rates
Jan APU
Rates for CO, PM2.5, and VOC are identical b/w January and July
30.654
30.511
30.367
36.000
30.224
30.080
29.937
1.710
8.749
XCO
ONOx
PM2.5-PRI
+VOC

Summary on Emission Factors

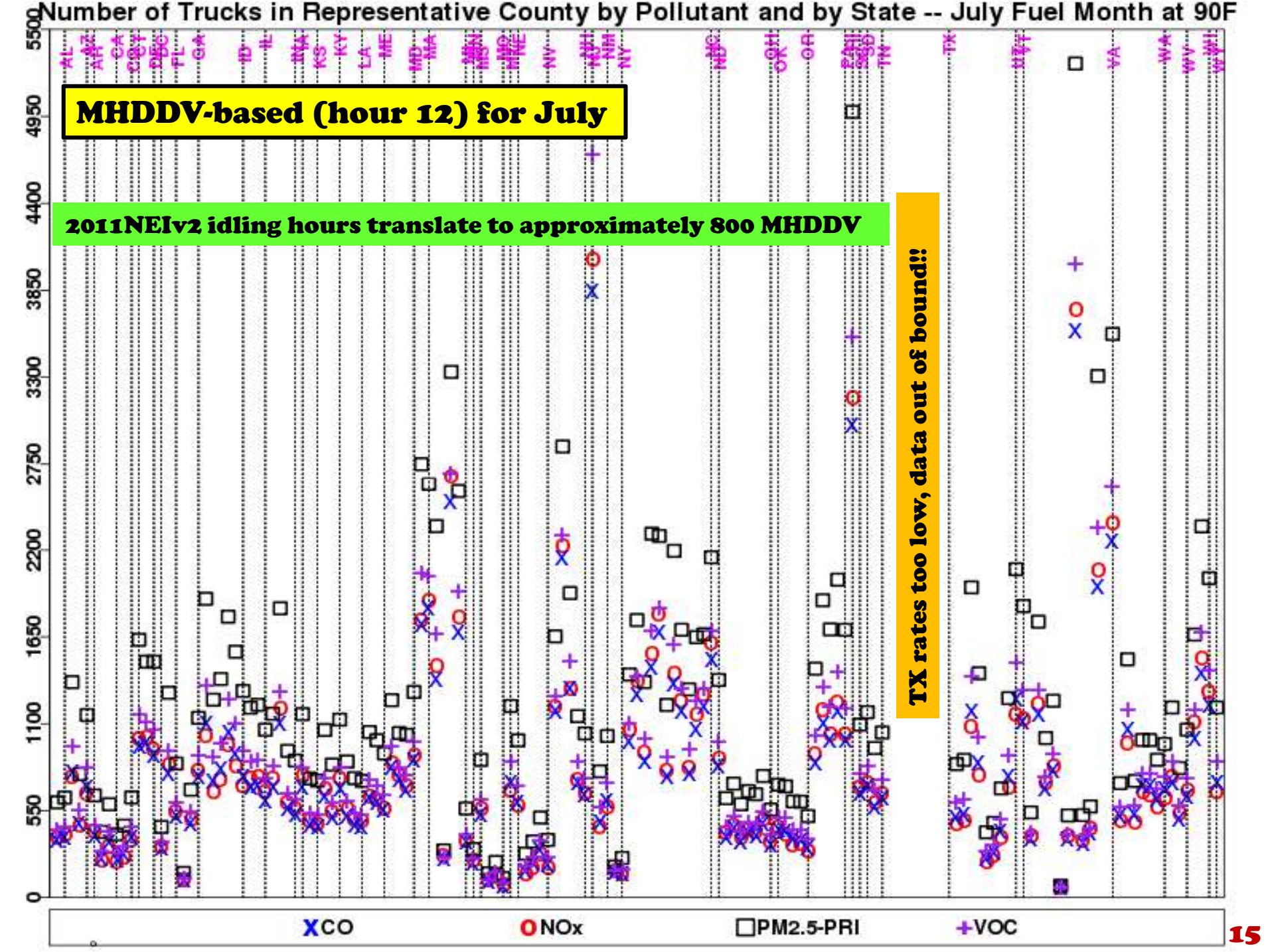
- CO, PM2.5, VOC
  - EXT and APU rates do not vary by fuel month
  - They vary by state in some cases, but not between counties in a given state
  - Inconsistent from state to state – why are some states lower than others?
- NOX
  - EXT and APU rates both vary widely among counties
  - Not much difference between summer and winter

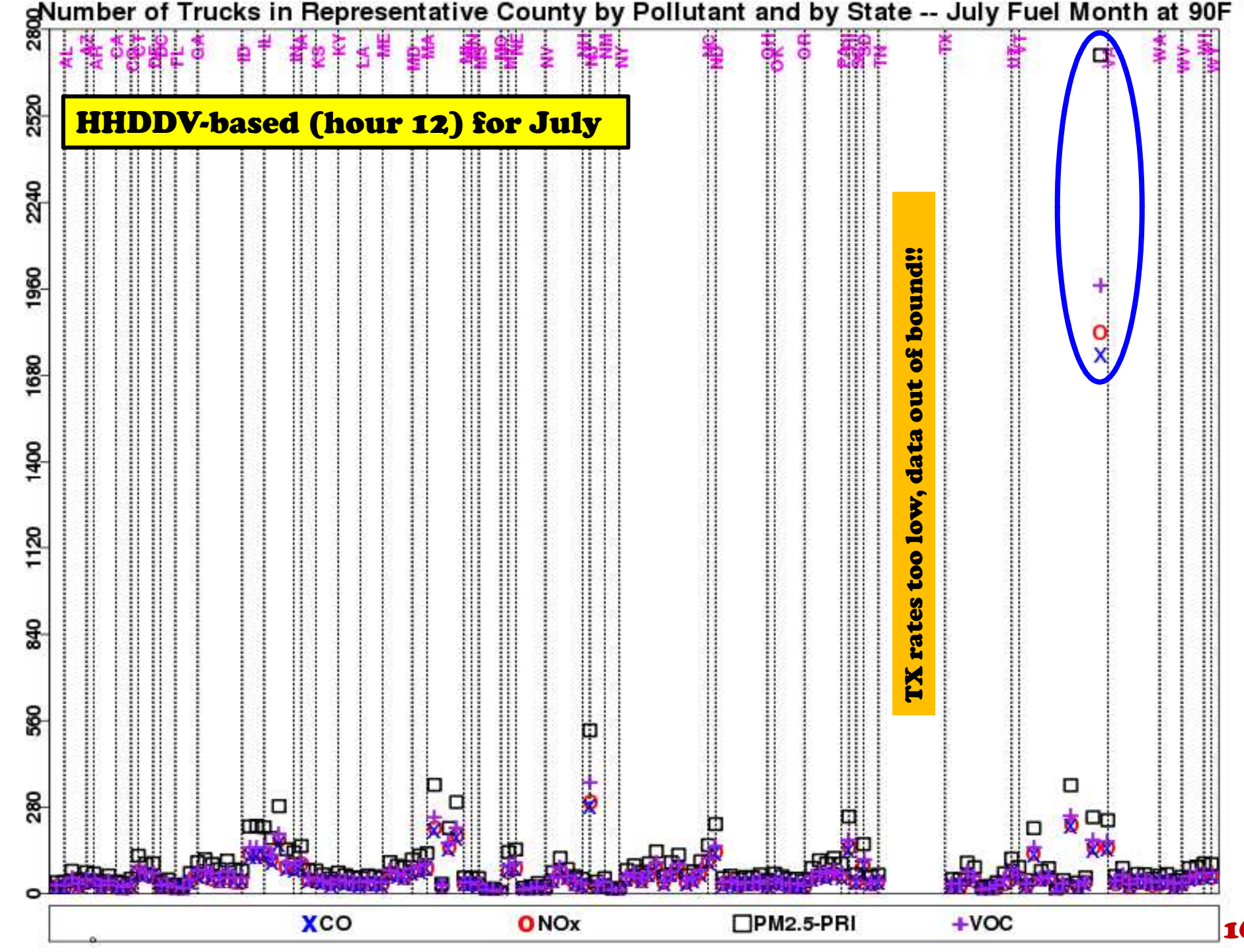
    EXT and APU 10-15% higher in January than in July
  - APU <<< EXT – Generally 1/10th
- How are idling hours and RPH (EXT, APU) rates developed? What factors determine them?

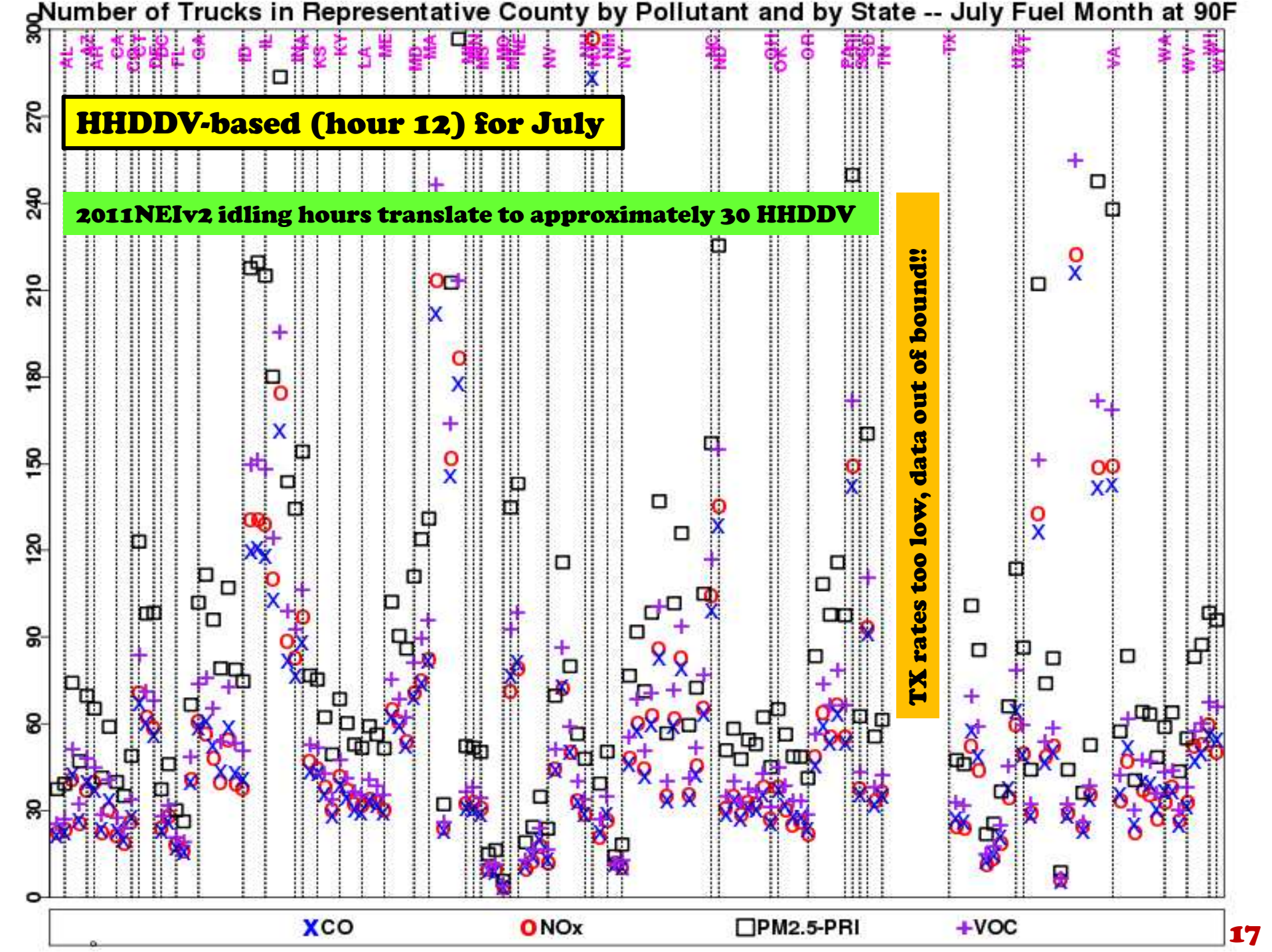
Idling Evaluation: Number of Idling Trucks

- EXT emission factors for 2011NEIv2 are tabulated in RPH (rate per hour) lookup tables by (284) representative county in g/hr
- EXT emission factors for 2011NEIv1 are tabulated in RPV (rate per vehicle) lookup tables by (164) representative county in g/hr/car
- 2011NEIv2 RPH / 2011NEIv1 RPV = (g/hr)/(g/hr/car) = "equivalent" number of trucks by county
- 2011NEIv1 tables have two rates:

  2230073390 (MHDDV) and 2230074390 (HHDDV)
- Calculate two sets of data for the same county for examination:
  - fuel month 7, temperature 90F, MHDDV-based
  - fuel month 7, temperature 90F, HHDDV-based


Number of Trucks in Representative County by Pollutant and by State -- July Fuel Month at 90F
MHDDV-based (hour 12) for July
2011NEIv2 idling hours translate to approximately 800 MHDDV
TX rates too low, data out of bound!!
0
550
1100
1650
2200
2750
3300
3850
4400
4950
5500
XCO
ONOx
PM2.5-PRI
+VOC


Number of Trucks in Representative County by Pollutant and by State -- July Fuel Month at 90F
HHDDV-based (hour 12) for July
TX rates too low, data out of bound!!
0
280
560
840
1120
1400
1680
1960
2240
2520
2800
XCO
ONOx
PM2.5-PRI
+VOC


Number of Trucks in Representative County by Pollutant and by State -- July Fuel Month at 90F
HHDDV-based (hour 12) for July
2011NEIv2 idling hours translate to approximately 30 HHDDV
TX rates too low, data out of bound!!
0
30
60
90
120
150
180
210
240
270
300
XCO
ONOx
PM2.5-PRI
+VOC

Summary on Number of Idling Trucks

- 2011NEIv2 idling hours translate to approximately 800 MHDDV or 30 HHDDV. Is this reasonable??
- Idling emission rates (g/hr) vary between NEIv1 and NEIv2. Were the emission factors changed between two versions?
- PM2.5 emission rates seem particularly different relative to the other pollutants examined

Overall Summary on Extended Idling

- Evaluations using parking space, emission factors, or vehicle count all found issues
- By Parking Space
  - Inconsistent with truck stop database. What methodology was used?
- By Emission Factors
  - EXT and APU rates for CO, PM2.5 and VOC do not vary by fuel month
  - Inconsistent from state to state. Why are some states lower?
  - How are idling hours and RPH (EXT, APU) rates developed? What factors determine them?
- General comments
  - Idling hours are by individual county, but emission factors are by representative county
  - "Extended idling" will need to be added to the growing list of selection criteria for grouping representative counties
  - Do annual EXT-APU emissions go through temporalization in SMOKE? How does this work?
  - Clear guidance is needed for states to run the models correctly. Will these issues be included in the soon-to-be-released technical guidance?

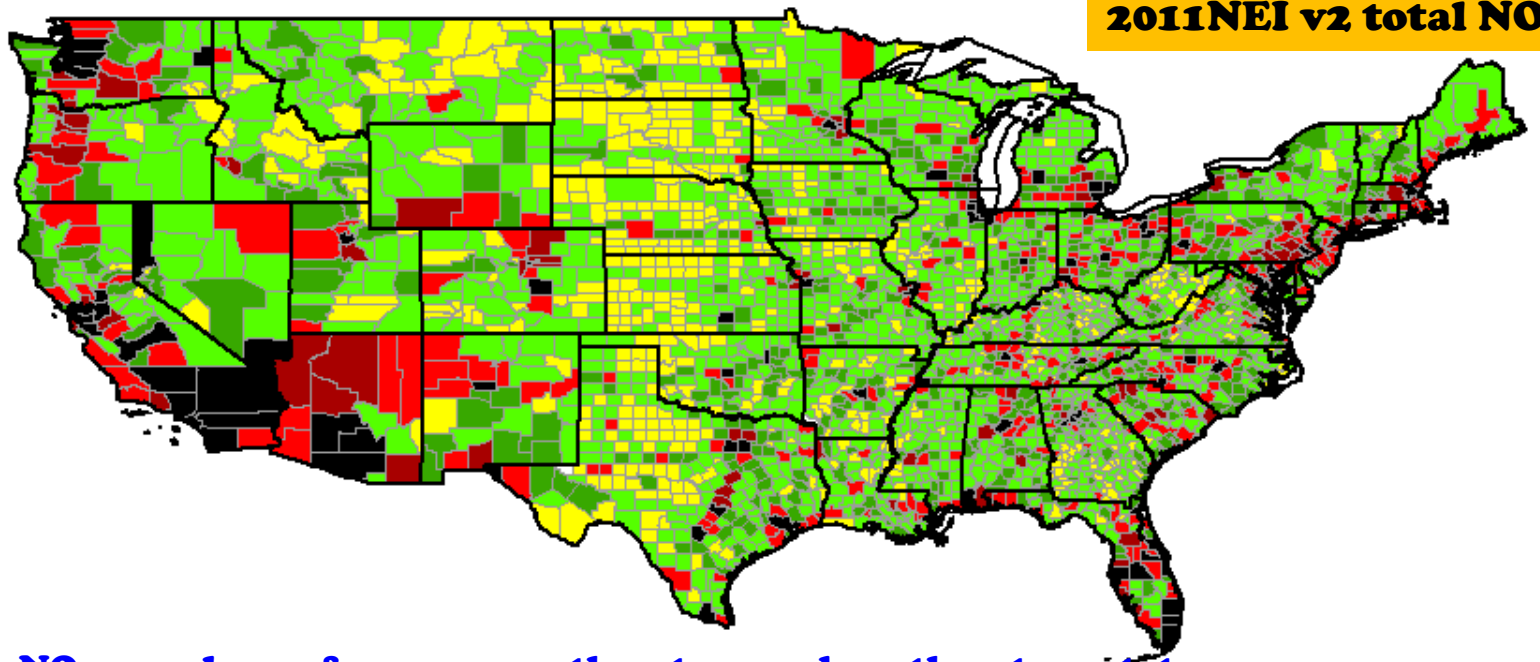
EPA please comment

Activities/Pollutants by SCC6

AAFFVVRRPP

AA: Mobile Source (22)
F F: MOVES Fuel Types
VV: MOVES Source Types
RR: MOVES Road Types
P P: MOVES Emission Processes

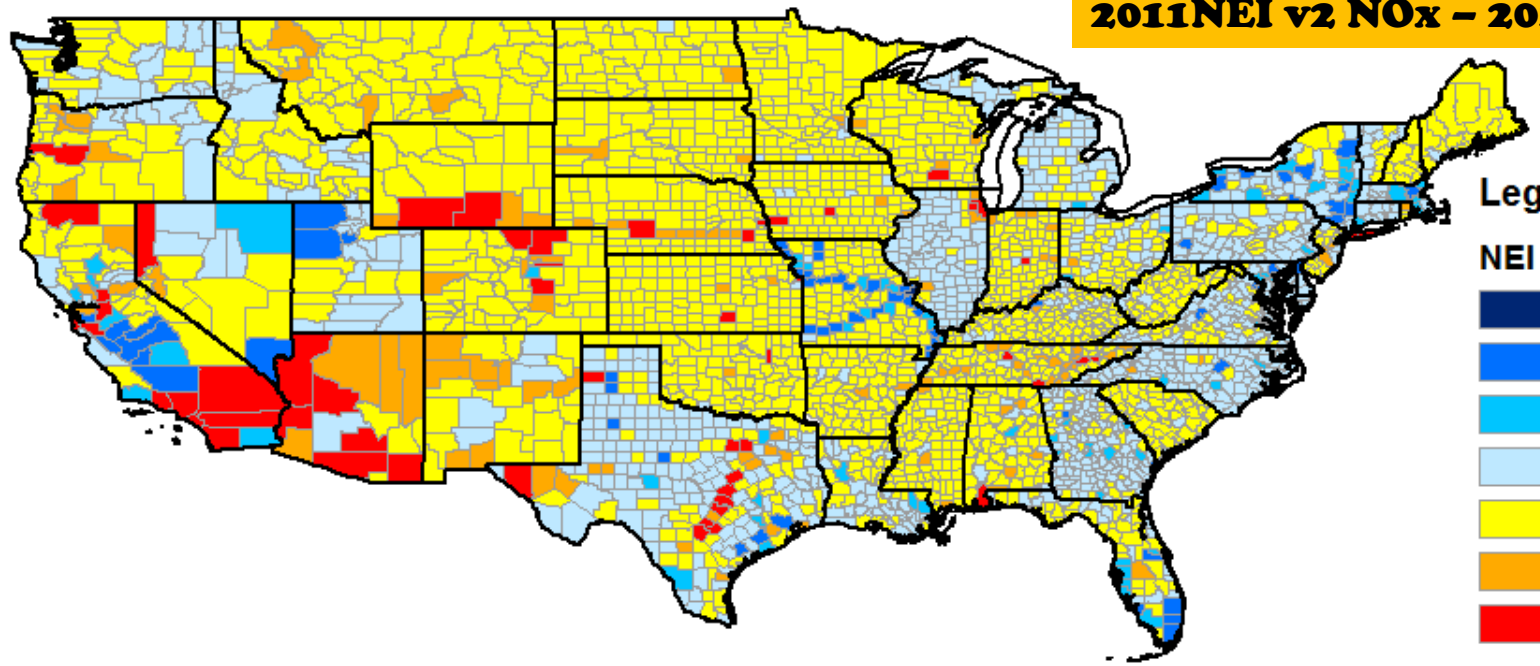
2011NEI v2 total NOx

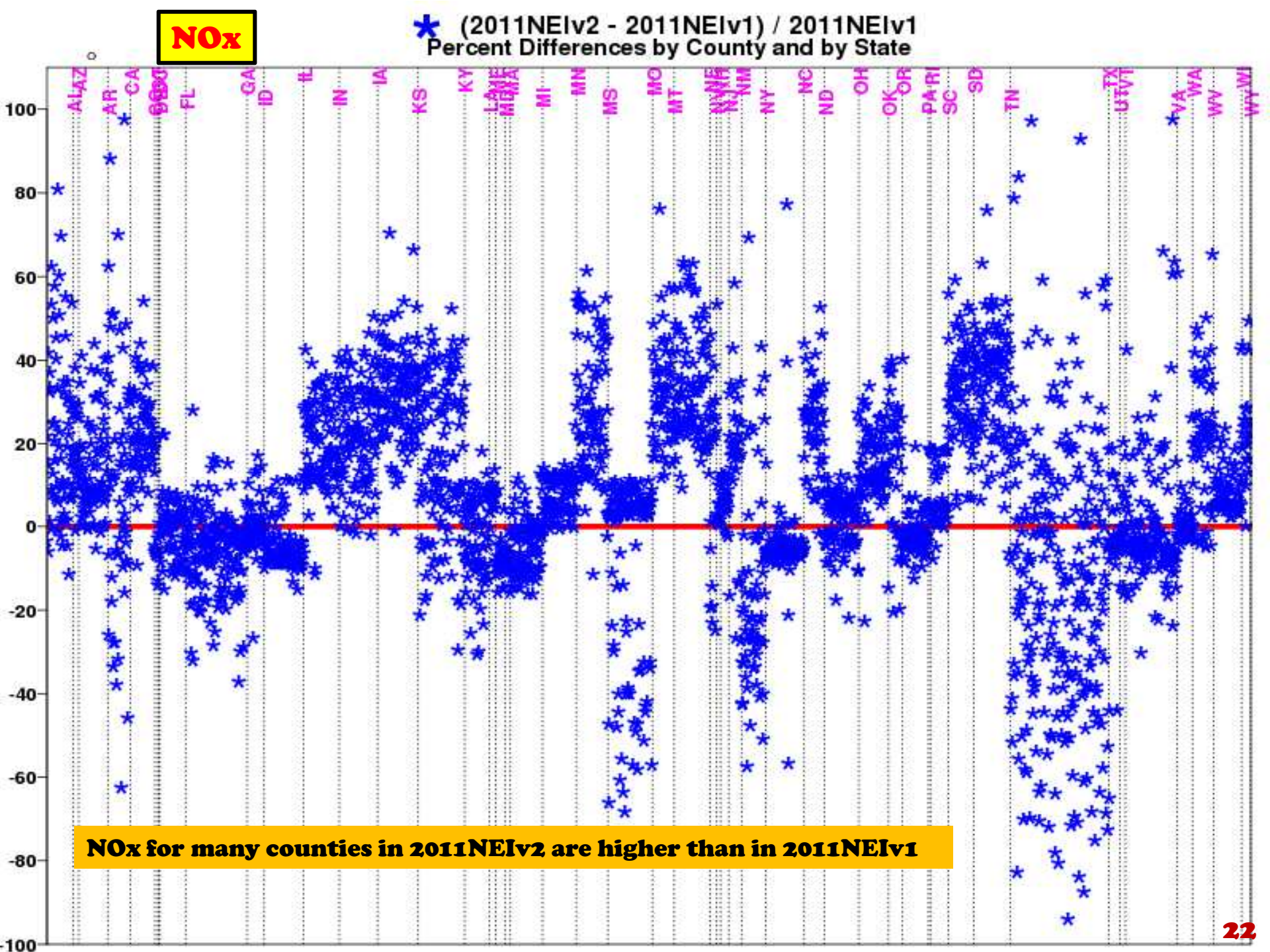


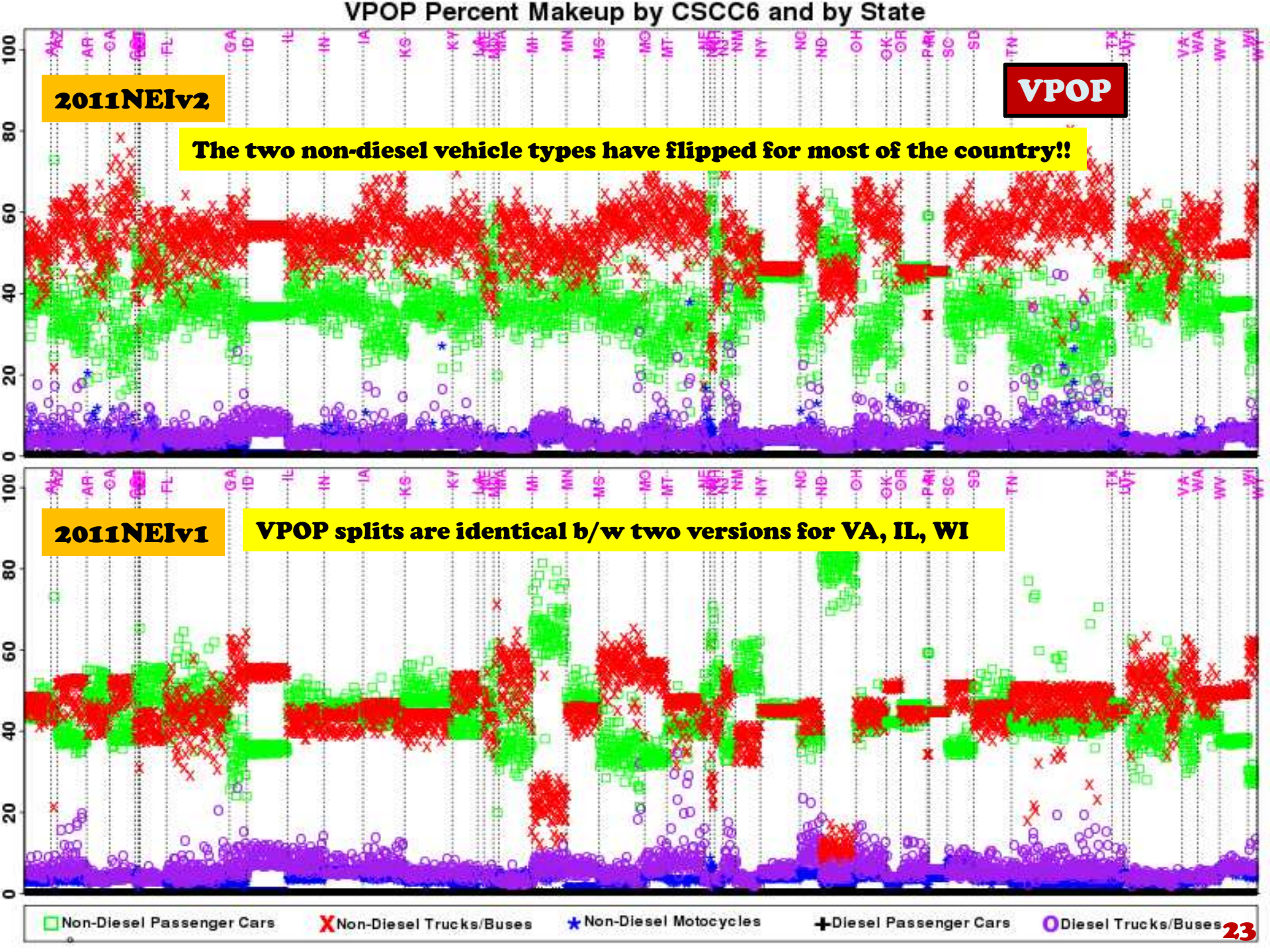
NOx now lower for many southeastern and northeastern states

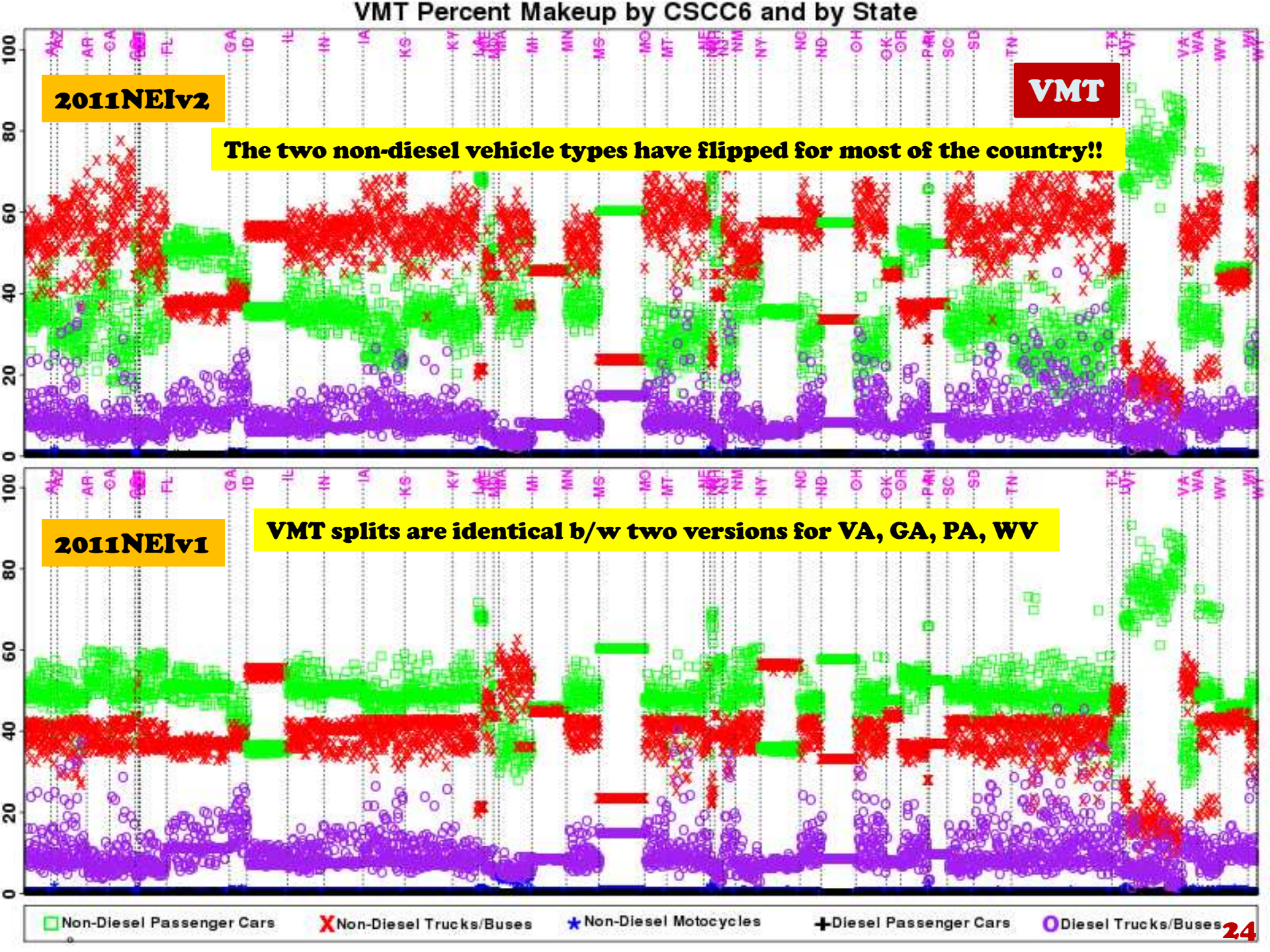
State participation has improved quality of inventory

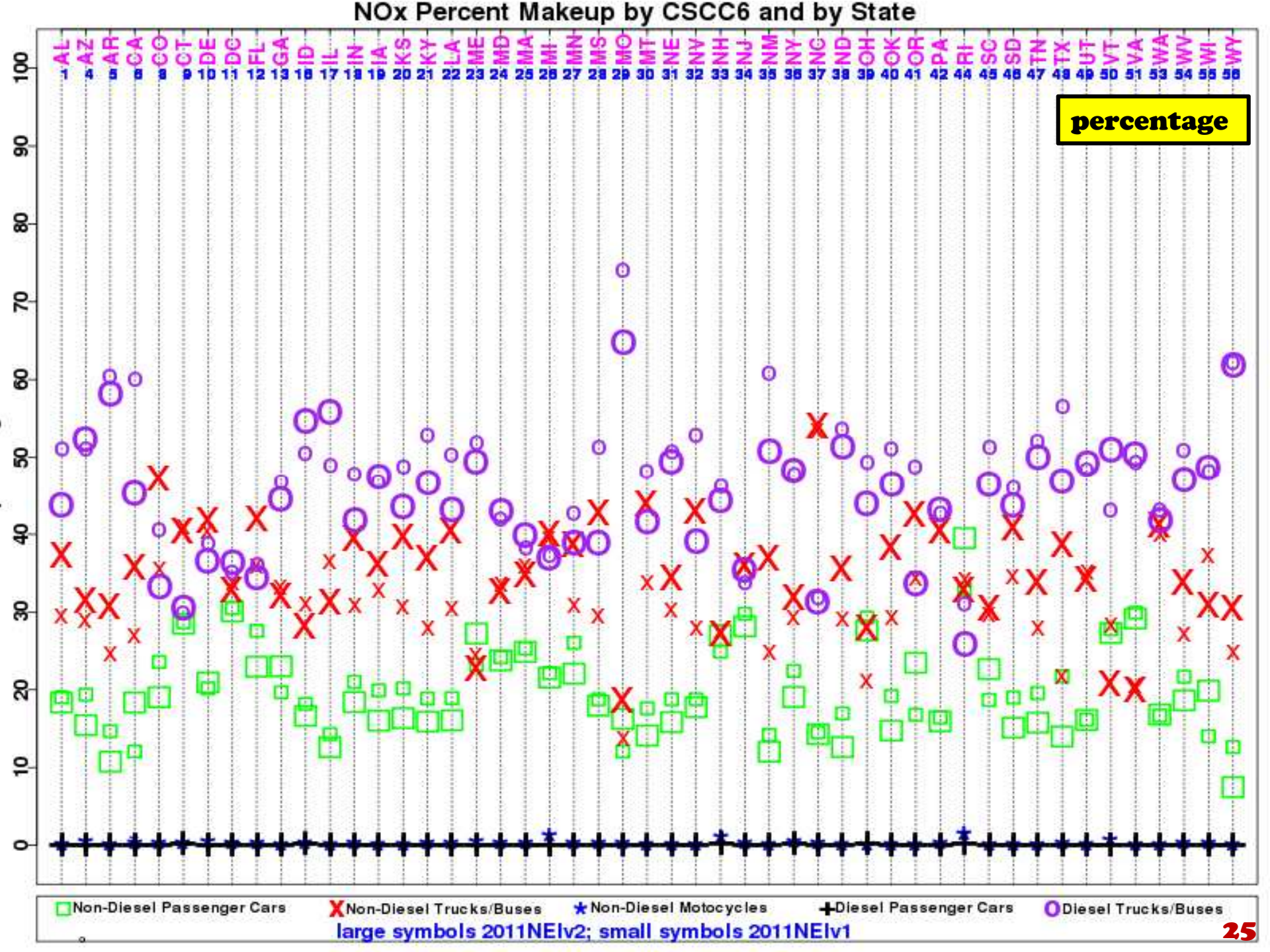
2011NEI v2 NOx – 2011NEI v1 NOx

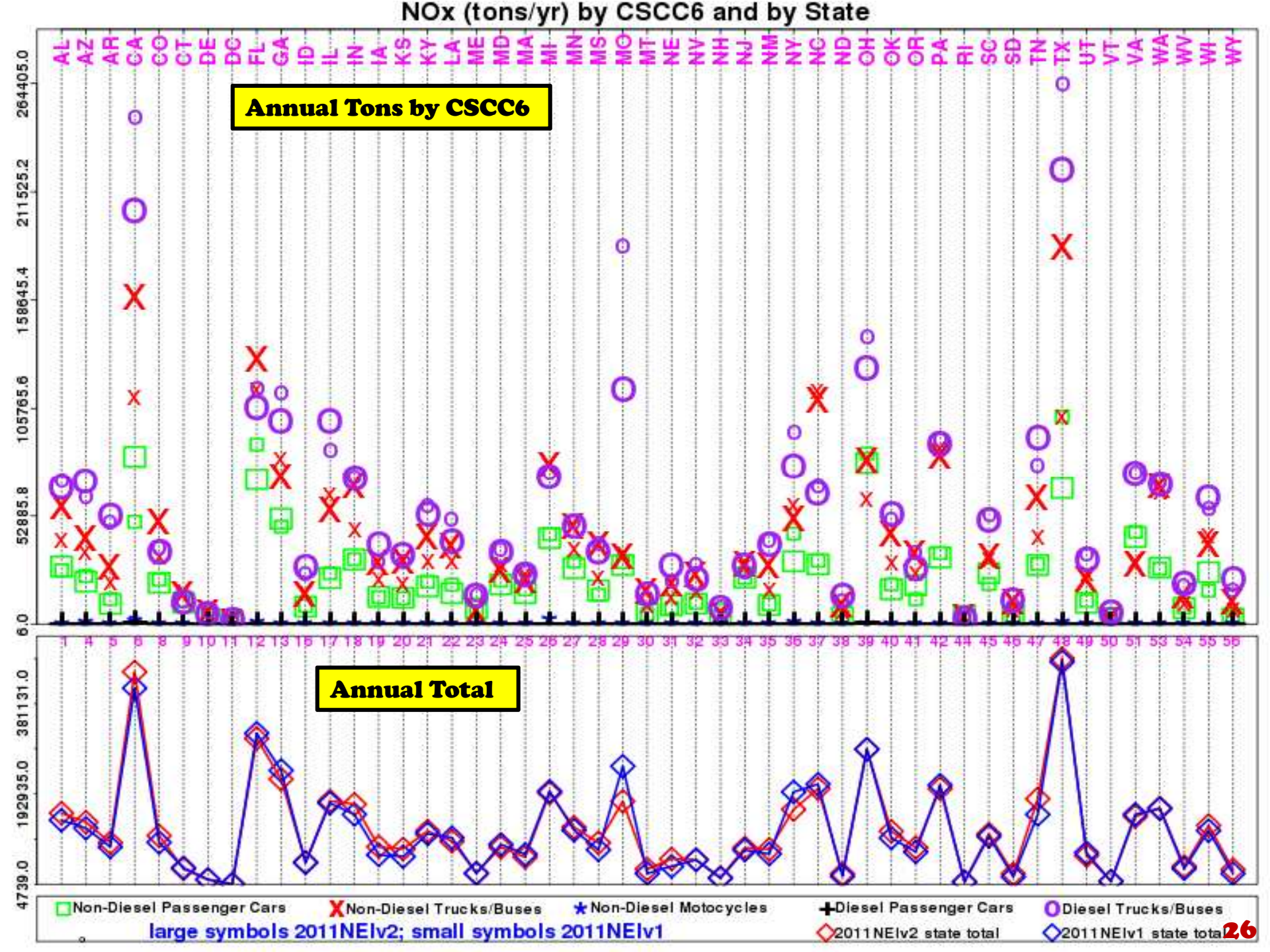



NOx
(2011NEIv2 - 2011NEIv1) / 2011NEIv1
Percent Differences by County and by State
100
80
60
40
20
0
-20
-40
-60
-80
-100
AL
AZ
AR
CA
FL
GA
ID
IL
IN
IA
KS
KY
LA
ME
MD
MA
MI
MN
MS
MO
MT
NE
NV
NH
NJ
NM
NY
NC
ND
OH
OK
OR
PA
RI
SC
SD
TN
TX
UT
VT
VA
WA
WV
WI
WY
NOx for many counties in 2011NEIv2 are higher than in 2011NEIv1


VPOP Percent Makeup by CSCC6 and by State
2011NEIv2
VPOP
The two non-diesel vehicle types have flipped for most of the country!!
2011NEIv1
VPOP splits are identical b/w two versions for VA, IL, WI
Non-Diesel Passenger Cars
Non-Diesel Trucks/Buses
Non-Diesel Motocycles
Diesel Passenger Cars
Diesel Trucks/Buses


VMT Percent Makeup by CSCC6 and by State
2011NEIv2
VMT
The two non-diesel vehicle types have flipped for most of the country!!
2011NEIv1
VMT splits are identical b/w two versions for VA, GA, PA, WV
Non-Diesel Passenger Cars
Non-Diesel Trucks/Buses
Non-Diesel Motocycles
Diesel Passenger Cars
Diesel Trucks/Buses

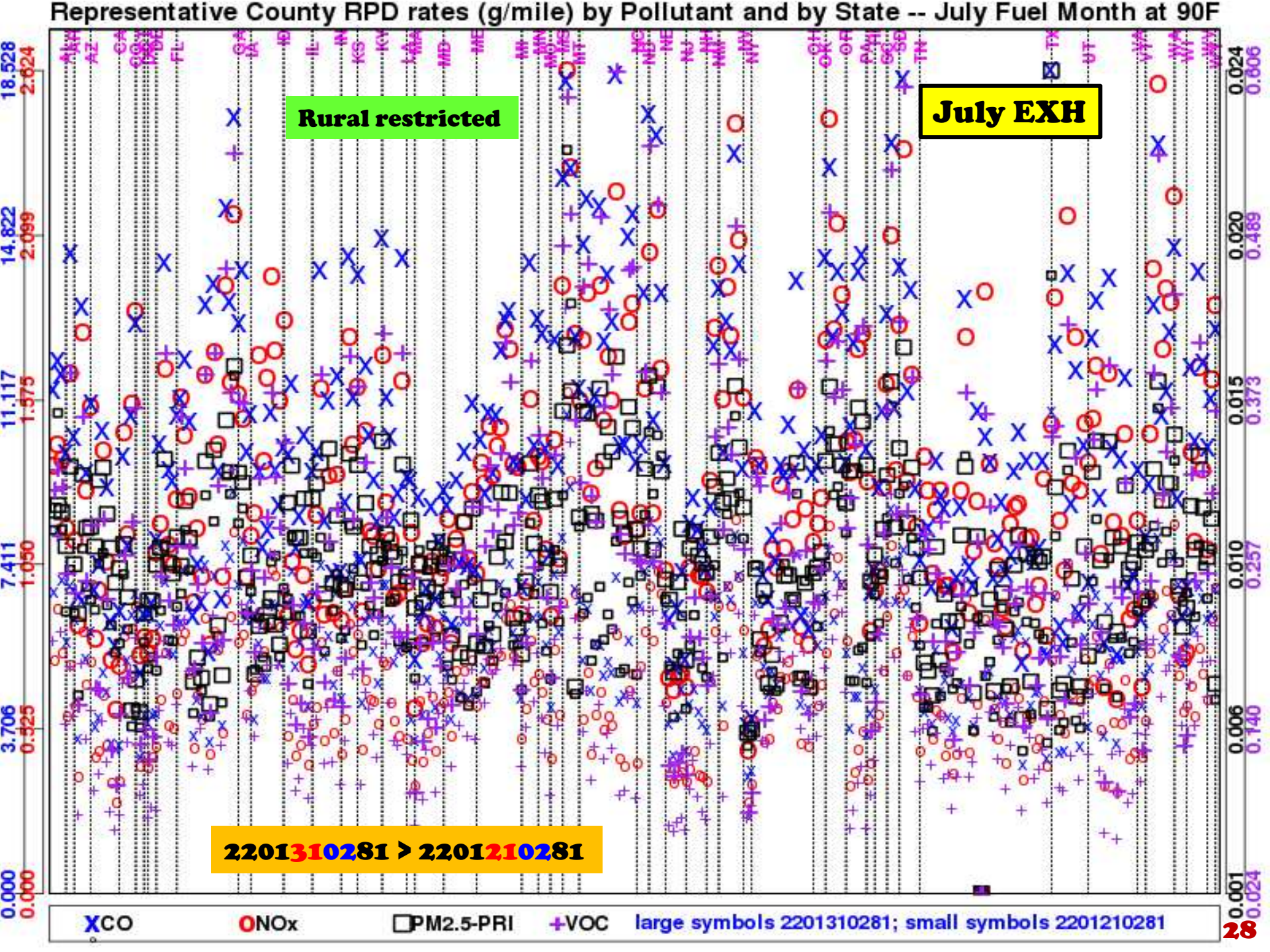

NOx Percent Makeup by CSCC6 and by State
AL 1
AZ 4
AR 5
CA 6
CO 8
CT 9
DE 10
DC 11
FL 12
GA 13
ID 16
IL 17
IN 18
IA 19
KS 20
KY 21
LA 22
ME 23
MD 24
MA 25
MI 26
MN 27
MS 28
MO 29
MT 30
NE 31
NV 32
NH 33
NJ 34
NM 35
NY 36
NC 37
ND 38
OH 39
OK 40
OR 41
PA 42
RI 44
SC 45
SD 46
TN 47
TX 48
UT 49
VT 50
VA 51
WA 53
WV 54
WI 55
WY 56
percentage
0
10
20
30
40
50
60
70
80
90
100
Non-Diesel Passenger Cars
Non-Diesel Trucks/Buses
Non-Diesel Motocycles
Diesel Passenger Cars
Diesel Trucks/Buses
large symbols 2011NEIv2; small symbols 2011NEIv1

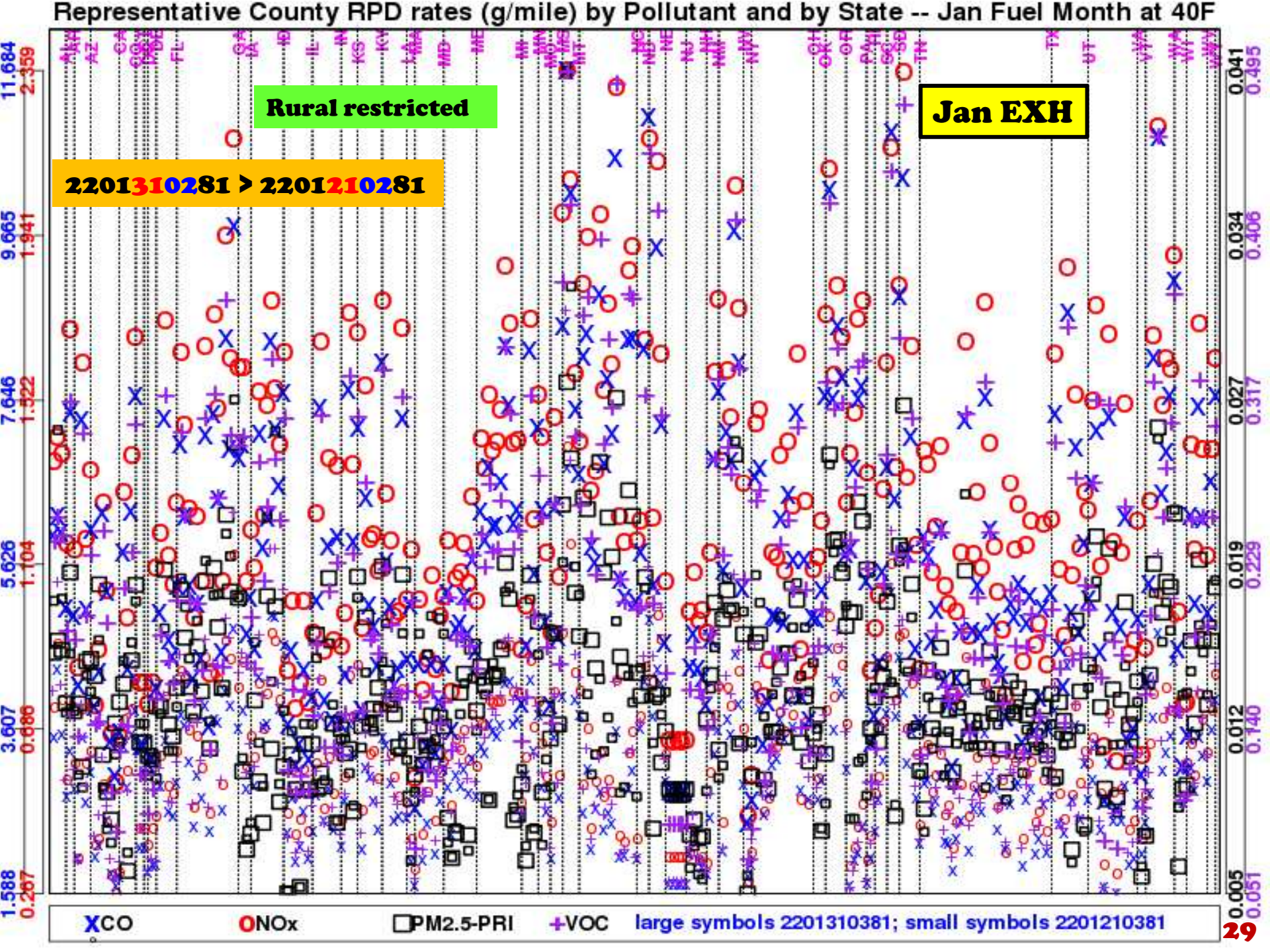

NOx (tons/yr) by CSCC6 and by State
Annual Tons by CSCC6
AL AZ AR CA CO CT DE DC FL GA ID IL IN IA KS KY LA ME MD MA MI MN MS MO MT NE NV NH NJ NM NY NC ND OH OK OR PA RI SC SD TN TX UT VT VA WA WV WI WY
264405.0
211525.2
158645.4
105765.6
52885.8
6.0
Annual Total
1 4 5 6 8 9 10 11 12 13 15 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 45 46 47 48 49 50 51 53 54 55 56
381131.0
192935.0
4739.0
Non-Diesel Passenger Cars
Non-Diesel Trucks/Buses
Non-Diesel Motocycles
Diesel Passenger Cars
Diesel Trucks/Buses
large symbols 2011NEIv2; small symbols 2011NEIv1
2011NEIv2 state total
2011NEIv1 state total

Effect of Vehicle Classification
RPD (Lookup) Tables

- Emission rates are calculated in MOVES by representative county
- RPD rates (g/mile) depend on fuel month (1 and 7), speed, temperature, and relative humidity
- Examine two vehicle types, 2201210281 (gasoline cars on rural restricted road) and 2201310281 (gasoline trucks on rural restricted road) traveling at spdbin=14 (62.5 – 67.5 mile/hr)
- Extract two sets of data for examination:
  - fuel month 7, temperature 90F
  - fuel month 1, temperature 40F

Relative humidity for each representative county is different


Representative County RPD rates (g/mile) by Pollutant and by State -- July Fuel Month at 90F
Rural restricted
July EXH
18.528
14.822
11.117
7.411
3.706
0.000
2.624
2.099
1.575
1.050
0.525
0.000
0.024
0.020
0.015
0.010
0.006
0.001
0.806
0.489
0.373
0.257
0.140
0.024
2201310281 > 2201210281
XCO
ONOx
PM2.5-PRI
+VOC
large symbols 2201310281; small symbols 2201210281


Representative County RPD rates (g/mile) by Pollutant and by State -- Jan Fuel Month at 40F
Rural restricted
Jan EXH
2201310281 > 2201210281
11.684
2.359
9.665
1.941
7.646
1.522
5.626
1.104
3.607
0.686
1.588
0.267
0.041
0.495
0.034
0.406
0.027
0.317
0.019
0.229
0.012
0.140
0.005
0.051
XCO
ONOx
PM2.5-PRI
+VOC
large symbols 2201310381; small symbols 2201210381

SCC Mapping

	CSCC6	HPMS (VMT 6) vehicle types	MOVES (VPOP13) source types	SCC (MOVES2014)	SCC (MOVES2010b)
(1)	Non-Diesel Passenger Cars	20	21	220121	LDGV
(2)	Diesel Passenger Cars			220221	LDDV
(3)	Non-Diesel Motorcycles	10	11	220111	MC
(4)	Non-Diesel Trucks/Buses	30, 40, 50, 60	31, 32, 41, 42, 43, 51, 52, 53, 54, 61, 62	Too tedious to list, but you get the drift	LDGT1, LDGT2, HDGV
(5)	Diesel Trucks/Buses				LDDT, 2BHDDV, LHDDV, MHDDV, HHDDV, BUSES

HPMS 20 and 30 have been combined to become 25 in MOVES2014

Non-Diesel Passenger Cars (1) and Non-Diesel Trucks/Buses (4) have flipped from MOVES2010b to MOVES2014

Summary on CSCC6

- Non-Diesel passenger cars and Non-Diesel trucks/buses have flipped from MOVES2010b to MOVES2014
  - HIGHER VPOP and VMT for trucks/buses
  - LOWER VPOP and VMT for passenger cars
- Systematic and region-wide
- Could be a result of adoption of CRC data
- Difference in assumptions or approach taken to allocate VMT between source types
- Emission factors for trucks/buses are greater than passenger cars, so the difference matters and the assumptions should be evaluated carefully

EPA please comment